Winter/Summer Aerosol Composition and Evolution Experiment (WACEE)

(Daum, Lee, Kleinman, Wang, Springston, McGraw, Fast)

Focus- Understanding of the processes associated with the formation and growth, and composition of aerosol particles, with a particular emphasis on the processes that lead to the formation secondary organic aerosol (SOA).

Winter/summer experiment pair proposed at the same location to gain insight into important processes by taking advantage of seasonal differences in both processing conditions and aerosol precursor sources.

SEASONAL DIFFERENCES LIKELY TO BE IMPORTANT

1. *Photochemistry-* Lower solar intensity and reduced absolute humidity will greatly reduce OH in winter relative to summer slowing down all photochemically driven processes including those involving O_3 and H_2O_2.
2. *Thermodynamics-* Distribution of semi-volatile substances (organics, nitrates…) will be enhanced during winter because of the lower temperatures.
3. *Precursors-* Seasonal differences in emissions, particularly biogenic emissions, should lead to seasonal differences in aerosol composition that may be useful in assessing the importance of these compounds in determining aerosol composition.

Scientific Questions

Scientific issues to be addressed include:

- POA emissions of representative anthropogenic and biogenic sources.
- Relationship between POA and black carbon in urban emissions
- Processing of POA in relation to photochemistry
- Formation of SOA in urban and power plant plumes in relation to photochemistry
- Formation of SOA from biogenic emissions with and without urban and power plant influences
- Hygroscopicity, light scattering and absorption coefficients, and CCN properties of aerosols as a function of sources, atmospheric age, and season.

SCIENTIFIC QUESTIONS, CONT'D

- Growth mechanism for SOA (i.e., condensation or Pankow-Seinfeld volume growth) as a function of processing conditions including summer/winter differences.

- Evolution of aerosol specific absorption as the aerosol ages.

- Winter/summer differences in aerosol precursors particularly biogenic precursors and their influence on aerosol composition.

- Whether current aerosol models can capture the seasonal differences in aerosol composition, particularly SOA.

DESIRED EXPERIMENTAL CONDITIONS

- Significant isolated urban source at a location that can be easily sampled by aircraft.
- Presence of isolated SO_2 point sources such as power plants.
- In a region with strong seasonal differences in the emissions of biogenic aerosol precursors.

POTENTIAL LOCATIONS

- NE US- Locate in Boston area and work in collaboration with potential experiment being considered by NOAA
- Base in the vicinity of a modest sized urban area in the mid-west. Possible sites include Columbus, OH, Minneapolis/St Paul, etc. Each has advantages, winter conditions may be too difficult.
- Locate in SE US, e.g., Nashville.

ADVANTAGES OF NASHVILLE

- Nashville is a fairly isolated urban area whose emissions as well as regional background can be well identified, tracked, and characterized.

- The city is located in the forested southeast US where biogenic hydrocarbon emissions, both isoprene and monoterpenes, are highly important

- There are at least four major power plants near the city, one located at the edge of the metropolitan area, the other three located ~100 km to the north and west.